

05/25/00

5-26-00

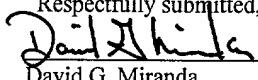
Express Mail Label No. EM400990306US

**UTILITY  
PATENT APPLICATION  
TRANSMITTAL**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

|                      |   |
|----------------------|---|
| Attorney Docket No.  | CTX-049   |
| First Named Inventor | Richard Hayton  |
| Title                | ACTIVITY MONITOR AND RESOURCE<br>MANAGER IN A NETWORK ENVIRONMENT |

jc714 U.S. PTO  
05/25/00

| APPLICATION ELEMENTS   | ADDRESS TO: <b>Box Patent Application</b><br><b>Assistant Commissioner for Patents</b><br><b>Washington, D.C. 20231</b>   |
|--|---|
| 1. <input checked="" type="checkbox"/> Fee Transmittal Form  | <b>ACCOMPANYING APPLICATION PARTS</b>   |
| 2. <input checked="" type="checkbox"/> Specification and Drawings [Total Pages 31]<br>- Specification - (18 pages)<br>- Claims - (8 pages)<br>- Abstract - (1 page)<br>- Sheets of Drawings - (4 sheets)<br><input type="checkbox"/> Formal<br><input checked="" type="checkbox"/> Informal  | 7. <input type="checkbox"/> 37 CFR 3.73(b) Statement (when there is an assignee)<br><input type="checkbox"/> Power of Attorney  |
| 3. <input checked="" type="checkbox"/> Oath or Declaration [Total Pages 3]<br>a. <input checked="" type="checkbox"/> Newly executed (original)<br>b. <input type="checkbox"/> Copy from a prior application (37 CFR 1.63(d))<br>(for continuation/divisional with Box 17 completed)<br>[Note Box 4 below]  | 8. <input type="checkbox"/> English Translation Document (if applicable)  |
| 4. <input type="checkbox"/> Incorporation by Reference (usable if Box 3b is checked)<br>The entire Disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 3b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.  | 9. <input type="checkbox"/> Information Disclosure Statement (IDS)/PTO-1449<br><input type="checkbox"/> Copies of IDS Citations   |
| 5. <input type="checkbox"/> Microfiche Computer Program (Appendix)   | 10. <input type="checkbox"/> Preliminary Amendment<br><input type="checkbox"/> Drawings [Total Sheets ]<br><input type="checkbox"/> Letter to Official Draftsperson Including Drawings [Total Pages ]   |
| 6. <input type="checkbox"/> Nucleotide and/or Amino Acid Sequence Submission<br><input type="checkbox"/> Computer Readable Copy<br><input type="checkbox"/> Paper Copy (identical to computer copy)<br><input type="checkbox"/> Statement verifying identity of above copies   | 11. <input checked="" type="checkbox"/> Return Receipt Postcard   |
| 17. <input type="checkbox"/> If a <b>CONTINUING APPLICATION</b> , check appropriate box and supply the requisite information:<br><input type="checkbox"/> Continuation <input type="checkbox"/> Divisional <input type="checkbox"/> Continuation-in-part (CIP) of prior application Serial No. ____/____.<br><b>Priority to the above application(s) is claimed under 35 U.S.C. 120.</b><br>Prior application information: Examiner: _____. Group/Art Unit: _____. | 12. <input type="checkbox"/> Small Entity Statement(s)<br><input type="checkbox"/> Statements filed in prior application, (Status still proper and desired)   |
| 18. <input type="checkbox"/> <b>Priority - 35 U.S.C. 119</b><br><input type="checkbox"/> Priority of application Serial No. _____ filed on _____ in _____ is claimed under 35 U.S.C. 119.<br><input type="checkbox"/> The certified copy has been filed in prior U.S. application Serial No. ____/____ on _____.<br><input type="checkbox"/> The certified copy will follow.   | 13. <input type="checkbox"/> Certified Copy of Priority Document(s)   |
| <b>CORRESPONDENCE ADDRESS</b>  | <b>SIGNATURE BLOCK</b>  |
| Direct all correspondence to: Patent Administrator<br>Testa, Hurwitz & Thibault, LLP<br>High Street Tower<br>125 High Street<br>Boston, MA 02110<br>Tel. No.: (617) 248-7000<br>Fax No.: (617) 248-7100  | Date: May 25, 2000<br>Reg. No. 42,898<br>Tel. No.: (617) 248-7954<br>Fax No.: (617) 248-7100<br><br>Respectfully submitted,<br><br>David G. Miranda<br>Agent for Applicant<br>Testa, Hurwitz & Thibault, LLP<br>High Street Tower<br>125 High Street<br>Boston, MA 02110 |

MIRANDDG\1545\83.1000339\_1

## Inventor Information

Inventor One Given Name :: Richard  
Family Name :: Hayton  
Name Suffix :: Dr.  
Postal Address Line One :: 2a Newnham Lane  
Postal Address Line Two :: Burwell  
City :: Cambridge  
State/Province ::  
Country :: United Kingdom  
Postal or Zip Code :: CB5 0EA  
City of Residence :: Cambridge  
State/Prov. of Residence ::  
Country of Residence :: United Kingdom  
Citizenship :: British

## Correspondence Information

Correspondence Customer Number :: 021323

## Application Information

Title Line One :: ACTIVITY MONITOR AND RESOURCE MANAGER  
Title Line Two :: IN A NETWORK ENVIRONMENT  
Total Drawing Sheets :: 4  
Formal Drawings :: N  
Application Type :: Utility  
Docket Number :: CTX-049  
Licensed - U S Government Agency ::  
Contract Number ::  
Grant Number ::  
Secrecy Order in Parent Application ::

## Representative Information

Representative Customer Number :: 021323

## Continuity Information

This application is a ::  
>Application One ::  
Filing Date ::  
Patent Number ::  
which is a ::  
>>Application Two ::  
Filing Date ::  
Patent Number ::

## Prior Foreign Applications

Foreign Application One ::

Filing Date ::

Country ::

Priority Claimed ::

MIRANDDG\1545\83.1000336\_1

Activity Monitor and Resource Manager in a Network Environment

Field of the Invention

The present invention relates generally to apparatus and methods for resource management in a client/server environment and more specifically to an apparatus and  
5 method for managing resources on the server and network in response to monitored activity on the client.

Background of the Invention

Computer communication networks typically include one or more nodes termed server nodes and one or more nodes termed client nodes. A server provides a  
10 service to a client upon receiving a request from the client. An example of a service is the execution, on the server, of an application with which the user of the client wants to interact.

Once a client has established a connection with the server, the server allocates certain necessary server resources to that client to perform the requested services. For  
15 example, these server resources may include resources necessary to maintain the connection between the client and resources and resources necessary to execute the requested application. Once these resources are allocated to this client, they are not available for another client that subsequently connects to the server.

A problem that arises is that the server continues to allocate these resources  
20 even though the user is inactive on the client. This typically occurs with application where the server is continually updating the client with information, "server push"

applications, and thus is neither monitoring nor detecting client inactivity. Another problem is that if the server does monitor client inactivity and terminates communication resources in response to this server monitoring, the server may not be able to easily reestablish communication. For example, firewall security will typically prohibit the server from reestablishing communication, and thus the client will have to reestablish communication. Typically it will appear to the user of the client that he is establishing a new connection and repeating the process over from the beginning. These problems create a need for managing server resources in response to the actual user activity level on the client.

10           The present invention addresses this need.

#### Summary of the Invention

The invention relates to an apparatus and method for monitoring, by a client node, the activity level of a user on the client and managing, by a server, the network resources, including server resources, in response to the level of activity identified by the client. This combination allows the server to manage its resources in the most efficient manner while at the same time creating a substantially seamless interaction with the user on the client, in response to the user's activity level.

In one embodiment the invention relates to a method for managing network resources. The method includes the steps of allocating on a server at least one server resource to a client; monitoring activity of a user by the client to detect a change in the level of activity; transmitting to the server from the client a notification of change of

activity; and managing the at least one allocated server resource on the server in response to the notification. In one embodiment the notification of change of activity is in response to user inactivity. In another embodiment the method further includes the step of storing state of the at least one allocated server resource, when the notification is  
5 received, for resumption at substantially the same state in response to a subsequent notification of change of activity. In another embodiment the method further includes the steps of terminating transmission of output data to the client associated with an application executing on the server in response to the notification; storing the output data in a storage area following the notification; and transmitting the stored output data to said  
10 client in response to a subsequent notification of change of activity. In yet another embodiment the method includes the step of reducing the at least one allocated server resource on the server in response to the notification.

In another embodiment the invention relates to a system for managing network resources. The system includes a server including a resource manager and a server  
15 communication link in communication with the resource manager, and a client in communication with the server. The client includes an activity monitor and a client communication link in communication with the activity monitor. The client activity monitor detects a level of activity of a user on the client and in response to a change in the activity transmits over the communication link to the server a notification of change  
20 of activity. The server resource manager, in response to the notification, manages server resource associated with the client. In one embodiment the notification of change of

activity represents user inactivity. In another embodiment the server further includes a server first storage buffer in communication with the resource manager. The server stores output data generated by an application in the first storage buffer in response to the notification. In another embodiment the server transmits the output data, stored in the

5 first storage buffer, to the client in response to a subsequent notification of change of activity. In yet another embodiment the server further includes a server second storage buffer in communication with the resource manager. The server stores the state of the allocated resource, when the notification is received, for resumption at substantially the same state in response to a subsequent notification of change of activity. In still yet

10 another embodiment the invention relates to a client for monitoring user activity. The client includes an activity monitor and a communication link in communication with the activity monitor. The client activity monitor detects a level of activity of a user on the client and in response to a change in the level of activity transmits, over the communication link to an external server, a notification of change of activity. In one

15 embodiment the notification of change of activity represents user inactivity. In another embodiment the client communication link initiates re-establishing communication with the server in response to the notification. In still yet another embodiment the activity monitor further includes a notification generator; an inactivity timer in communication with the notification generator; and user detection I/O in communication with the

20 inactivity timer and the notification generator. The user detection I/O detects lack of activity of a user on the client and transmits the result of the detection to the inactivity

timer. In response to the result, the inactivity timer starts counting until it is either reset by detection of activity by the user I/O or counts to a predetermined value. The notification generator, in response to the inactivity timer reaching the predetermined value transmits, over the communication link to an external server, a notification of  
5 change of activity.

In still yet another embodiment the invention related to a server for managing resources allocated to an external client. The server includes a resource manager and a communication link in communication with the resource manager. The server resource manager, in response to a notification of change of activity from an external client  
10 received over the communication link, manages the server resource associated with the external client. In another embodiment the notification of change of activity represents user inactivity. In another embodiment the server further includes a first storage buffer in communication with the resource manager. The server stores output data generated by an application in the first storage buffer in response to the notification.

#### Brief Description of the Drawings

The foregoing and other objects, features and advantages of the present invention, as well as the invention itself, will be more fully understood from the following description of preferred embodiments, when read together with the accompanying drawings, in which:

FIG. 1 is a high level block diagram of an embodiment of the invention.

FIG. 2 is a more detailed block diagram of an embodiment of the invention shown in Fig. 1.

FIG. 3 is a block diagram of another embodiment of the invention in which the client monitors multiple applications independently.

5           FIG. 4 is a flow chart depicting of an embodiment of a process of the invention by which a client monitors for inactivity, notifies the server of the inactivity and the server reacts in response to client inactivity.

#### Detailed Description of Preferred Embodiments

10           In broad overview, FIG. 1 depicts a system 10 in which a client 14 and a server 18 communicate with each other over a communication channel 22, using the server communication link 26 and the client communication link 34. Once a client 14 establishes communication with the server 18 and requests a service, a resource manager 30 allocates the necessary resources to maintain the communication with the client 14 and perform the requested service.

15           An activity monitor 38 monitors the user activity on the client 14 through the user detection I/O 42, which is described in more detail below. When the activity monitor 38 detects that the user has not been active on the client 14 for a predetermined period of time, the activity monitor 38 generates a notification of change of activity, representing user inactivity. The activity monitor 38 transmits the notification to the  
20   client communication link 34. Once a notification of activity has been generated, the

activity monitor 38 continues to monitor the user detection I/O 42 for resumption of activity by the user. Upon detection, the activity monitor 38 generates a notification of change of user activity, representing user activity. The activity monitor 38 transmits the notification to the client communication link 34.

5           The client communication link 34 transmits the notification, representing either activity or inactivity, to the server communication link 26, which in turn transmits the notification to the resource manager 30. In response to the notification 46, the resource manager 30 manages the allocated resources as applicable, as is described in more detail below.

10           FIG. 2 depicts the server 18 and the client 14 in more detail. In one embodiment, the user detection I/O 42 (FIG. 1) with which the activity monitor 38 interacts includes a keyboard 74 and/or a mouse 70. The activity monitor 38 simply monitors the drivers of these devices to verify that there is a user interacting with the client 14. As known in the art, the activity monitor 38 may not have to monitor the  
15   keyboard 74 and mouse 70 drivers directly. In another embodiment, the activity monitor 38 monitors the screensaver API, which is informed of keyboard 74 and mouse 70 inactivity after a period of time. In another embodiment, the activity monitor 38 is sent keyboard 74 and mouse 70 events directly by the operating system.

          In an embodiment where there is not an external resource monitoring keyboard  
20   74 and mouse 70 activity, the activity monitor 38 must time the period of inactivity. When the keyboard 74 and mouse 70 become inactive, the activity monitor 38 starts a

005250-672560

timer. The timer simply counts up, over time, clock pulses or other accepted periodic increments, until it reaches a predetermined maximum value. In another embodiment, the timer may start at the maximum value and count down. If at any time while the timer is counting, the activity monitor 38 detects user interaction, the timer will be reset to the  
5 initial state (e.g., zero or the maximum value). Once the timer counts up to the predetermined maximum value, or counts down to zero, the activity monitor 38 generates a notification of change of activity and transmits the notification to the server 18 as described above. In this case, the notification represents user inactivity. In one embodiment, if the operating system of the client 14 is monitoring for a period of  
10 inactivity, the activity monitor 38 can set the user selectable period of time in the operating system to the predetermined maximum value.

Subsequent to transmitting the notification of change of activity, the activity monitor 38 continues monitoring the keyboard 74 or mouse 70 for the resumption of user activity. When the user becomes active again (e.g., the activity monitor 38 detects a  
15 driver in use), the activity monitor 38 generates a notification of change of activity and transmits the notification to the server 18 as described above. In this case, the notification represents user activity.

In another embodiment the activity monitor 38 monitors the display 66 of the client 14 and detects when a system screensaver is initiated. The mechanism to detect the  
20 screensaver initialization is specific to the operating system (e.g., WINDOWS® of Microsoft Corp. of Redmond, WA, X of X.org for Unix® of The Open Group of Woborn

009290-06960

MA) of the client 14 and is well documented for each of the operating systems. When the system screensaver initiation is detected, the activity monitor 38 generates a notification of change of activity and transmits the notification to the server 18 as described above. In this case, the notification represents user inactivity. When the system screensaver is terminated, the activity monitor 38 generates a notification of change of activity and transmits the notification to the server 18 as described above. In this case, the notification represents user activity.

In some cases, a typical user response is to move the mouse 70 immediately after the screensaver is initiated, thus terminating the screensaver. With this response, a notification representing user activity is sent immediately after a notification representing user inactivity. This unnecessarily uses communication channel 22 and server 18 resources. In one embodiment, to prevent this use of resources the activity monitor 38 waits a predetermined small amount of time after the screensaver is initiated before transmitting the notification representing user inactivity.

When a screensaver is used, there are many different sources that can provide the screensaver. In one embodiment, the screensaver that is displayed on the display 66 of the client 14 is a display provided by the operating system of the client 14. In another embodiment, the screensaver that is displayed on the display 66 of the client 14 is a display that is generated by the activity monitor 38. This screensaver can provide status information to the user. In yet another embodiment, the screensaver that is displayed on the display 66 of the client 14 is a display transmitted by the display generator 84 of the

server 18. The display can be indicative to the user of an idle server connection to remind the user that a server connection still exists but is at a reduced allocation of resources. The display generator 84 can be a simple storage device storing a graphic image to be displayed. The display generator 84 can be an additional application that  
5 generates advertisements based on the services that the server 18 is providing for the client 14.

In another embodiment, the activity monitor 38 monitors other detection means 78 to determine user activity. These other detection means 78 can include technologies that detect whether there is user is physically at the client 14. For example  
10 other detection means 78 can include infrared detection of user's body temperature or video detection using a digital video camera in combination with image recognition software or motion detection. When other detection means 78 is used, the activity monitor 38, in one embodiment, uses the same inactivity timer as described above, to count a period of inactivity prior to transmitting a notification.

15 On the server 18, the resource manager 30 receives the notification from the client 14 and takes action in response to this notification. The exact action that the resource manager 30 takes is dependent on the services that the server 18 is providing for that particular client 14. If the resource manager 30 receives a notification indicating user inactivity, the resource manager will start reducing some or all of the allocated  
20 resources for that client 14. The means for transmitting the notification varies with the protocol of the communication channel 22 between the client 14 and server 18. If the

protocol does not support the notification, the client 14 can initiate a second communication channel 22' (not shown) specifically for the notification transmissions, using a protocol that supports the notification (e.g., a simple HTTP connection).

One of the services the server 18 provides to the client 14 can be, for example, the execution of an application 94. In one embodiment, the application 94 is of no use to the user once he or she leaves the client 14. In this embodiment, the resource manager 30 terminates the execution of that application 94 in response to the notification.

In another embodiment, the application 94 is of no use to the user while he or she is not interacting with the client 14, but the user will want to resume the application at the point in the execution of the application where they left off. In this embodiment, the resource manager 30 suspends the execution of that application 94 in response to the notification, and upon suspension, stores the state of the application in the storage buffer 80. This suspension allows the server CPU 88 resources that were needed for execution of the application 94 to be used for other services. Upon a subsequent notification from the client 14 representing user activity, the resource manager 30 retrieves the state of the application 94 from the storage buffer 80 and resumes execution of the application 94 at the stored state. This resumption requires the resumption of the server CPU 88 resources needed for execution of the application 94.

In another embodiment, the application 94 the user wants the output of the application 94 while he or she is not interacting with the client 14. In this embodiment, the resource manager 30 terminates transmitting the output of that application 94 to the

client 14 in response to the notification representing user inactivity. Instead, the output of the application is stored in the storage buffer 80. This frees up resources on the communication channel 22 for other clients in the network while the client is not interacting with the client 14. Upon a subsequent notification from the client 14

5 representing user activity, the resource manager 30 retrieves the stored output from the storage buffer 80 and transmits the stored output data to the client 14. In another embodiment, the stored output is compressed to save on transmission resources. In another embodiment, the output data is limited to the most current display 66 at the time when the output data is re-transmitted to the client 18. In this case, the storage buffer 80

10 is limited to the size of the display 66. Each new piece of output overwrites the data in the storage buffer 80 that corresponds with the portion of the display 66 that has changed.

In another example, another service the server 18 provides to the client 14 can be maintaining the communication channel 22 between the client 14 and the server 18. In one embodiment, the resource manager 30, upon notification representing user inactivity,

15 reduces resources dedicated to maintaining communication between the client 14 and the server 18, but leaves the communication channel 22 connected. The resource manager 30 instructs the communications channel 22 that the connection is of low priority. For example, in one embodiment the communication channel includes a transmission mechanism that controls and reduces the amount of bandwidth consumed (e.g., Internet

20 Protocol, Quality of Service). In another embodiment, the resource manager 30 sends signals to the communication channel 22 hardware (e.g., routers manufactured by Cisco

Systems, Inc. of San Jose, CA) to de-prioritize the transmission stream. In another embodiment, the communication channel 22 provides a low level priority or Quality of Service, so that when designated as such by the resource manager 30, the transmission occurs only when there is nothing else being transmitted on the communication channel

5 22.

In another embodiment, the resource manager 30 or the activity monitor 38 disconnects the connection subsequent to the notification of change of activity representing user inactivity. In this embodiment, the server 18 and the client 14 engage in an interchange prior to disconnecting the connection. For example, the interchange

10 can be the exchange of state information to aid in the reconnection. In one embodiment, the activity monitor 38 can store this state information a client storage area (not shown). In another embodiment, the resource manager 30 can store this state information in the storage buffer 80. In another example, the interchange can be the exchange of protocol specific information to synchronize an asynchronous protocol. When the communication

15 channel 22 is disconnected, the client 14 typically initializes the re-establishment of the connection, due to firewall security schemes. In other embodiments however, the server 18 can re-establish the connection. For example, the server 18 can use a third party to request that the client 14 re-establishes the communication channel 22.

FIG. 3 depicts an exemplary embodiment of a system 10 in which the server

20 18 is executing two applications for the client 14. The output of each application is displayed in a separate application window 102, 112 on the client display 66. In this

embodiment, each application window 102,112 has a separate screensaver with which it is associated. The activity monitor 38 (FIG. 2) monitors each application window separately. When the user stops interacting with an application window 102, 112, the activity monitor 38 (FIG. 2) starts a timer, as described above, for that particular application window.

For example and illustration purposes, the user is only interacting with the application window 102 associated with executing application one 106. Since the user is not interacting with the application window 112 associated with executing application two 116 the activity monitor 38 (FIG. 2) starts counting, as described above. Once the timer reaches a predetermined value, a screensaver is initiated for that specific application window 112. The activity monitor 38 (FIG. 2) transmits a notification of change of activity associated with that specific application 116. In one embodiment, the screensaver that is displayed on the application window 112 associated with executing application two 116 is a display transmitted by the display generator 84 (FIG. 2) of the server 18. As described above, the display can be indicative to the user of reduced allocation of server resources for application two 116 or advertisements related to the application two 116. The resource manager 30 (FIG. 2) reduces resources allocated for that specific application two 116. For some examples, as described above the resource manager 30 (FIG. 2) can terminate execution of the application 116, save the current state of the application 116 or save the output of the application 116 to a storage buffer 80 (FIG. 2).

FIG. 4 depicts an exemplary embodiment of a process by which a client 14 (FIG. 2) monitors for a change in activity level, notifies the server 18 (FIG. 2) of the change in activity level and the server 18 reacts in response to the change in client activity level. The client 14 transmits (step 10) over the communication channel 22 (FIG. 2) from the client communication link 34 (FIG. 2) to the server 18 a request to execute an application 94 (FIG. 2). The server communication link 26 (FIG. 2) receives (step 14) the request and the server 18 executes (step 18) the requested application 94. As the application 94 creates output data, the application transmits the output data to the server communication link 26 (FIG. 2). The embodiment of FIG. 2 depicts the output data flowing through the resource manager 30 (FIG. 2). This is shown so the resource manager 30 can intercept data to store in the storage buffer 80 (FIG. 2). However, in other embodiments, this can be accomplished in other structures. For example, the output data can flow directly from the application 94 to the server communication link 26 and the resource manager 30 intercepts the output data from the server communication link 26. In another example, the output data can flow from the CPU 88 (FIG. 2), which is executing the instructions of the application 94 to the server communication link 26.

The sever communication link 26 transmits (step 22) the output data to the client 14. The client communication link 34 receives (step 26) the output data and displays (step 30) the output data on the client display 66 (FIG. 2). If there is more than one application window (e.g., the application windows 102 and 112 depicted in FIG. 3),

The server 18, in a continuous loop, executes (step 18) the application 94 and transmits (step 22) output data the application 94 generates until the client 14 sends a notification of change of user activity. In the depicted embodiment, the client 14 activity monitor 38 (FIG. 2) determines (step 34) whether the system screensaver has been activated. If it has, this indicates that the user has been inactive for a predetermined amount of time. The client 14 transmits (step 38) to all of the servers with which the client 14 is in communication a notification of change of activity representing user inactivity. If the system screensaver is not activated, the client 14 activity monitor 38 determines (step 42) whether a specific application window screensaver has been activated. If it has, this indicates that the user has not interacted with that particular application window for a predetermined amount of time. The client 14 transmits (step 46) to the server executing that application a notification of change of activity representing user inactivity with that respective application. If a specific application window screensaver has not been activated, the client 14, in a continuous loop, receives (step 26) and displays (step 30) output data and determines whether the system (step 34) or an application window (step 42) screensaver has been activated.

In some embodiments where the screensaver is used to monitor for inactivity, the screensaver will not be initiated as long as the server 18 is transmitting data to be displayed on the display 66 of the client 14. In one of these embodiments, the activity

monitor 38 forces the screensaver to be initiated when the inactivity period has been reached. For example, the activity monitor 38 can monitor the keyboard 74 or the mouse 70 or the other detection means 78 as described above, in parallel to monitoring the system screensaver. The determination of whether to override the system screensaver  
5 can be made by the activity monitor 38 or the resource manager 30. The determination can take into account who is providing the screensaver and whether the application 94 is a type that requires user interaction or physical presence.

When the server 18 receives the notification of change of activity representing user inactivity, the server manages (step 50) the resources associated with the specific  
10 inactive application(s). In the depicted embodiment, the server 18 determines (step 54) whether the server 18 should continue executing the application 94. If the server 18 terminates execution, the server stores (step 58) the current state of the application 94 in a storage buffer 80. If the server 18 continues executing the application 94, the server determines (step 62) whether the client 14 needs the output data generated while the user  
15 is inactive. If the client 14 does need the data, the server 18 stores (step 64) all of the generated output data in a storage buffer 80. If the client 14 does not need the data, the server 18 discards all of the generated output data until the server receives another notification representing user activity.

Subsequent to a screensaver becoming active, the client 14 activity monitor 38  
20 determines (step 70) whether the user inactivity has ended. For example, whether the screensaver has been deactivated. If the user inactivity has not ended, the activity

monitor continues monitoring. If the user inactivity has ended, the client 14 re-establishes (step 74) communication with the server 18. As described above, this can entail anything from simply transmitting over the communication channel 22, which remained open during inactivity, to re-establishing a connection with the server 18.

5 Subsequent to re-establishing communication with the server 18, the client 14 transmits a notification of change of activity representing user activity. In response to the notification, the server 18 resource manager 30 manages the resources. In this case where the notification represent user activity, the resource manager 30 re-establishes (step 78) resources necessary to provide the prior requested (step 10) services. For  
10 example, this can include obtaining the state of the application from the storage buffer 80 and beginning execution of the application 94 at that state. This can also include obtaining (step 82) the output data stored (step 64) in the storage buffer 80. The server 18 transmits (step 22) this stored output data to the client 14 and continues executing (step 18) the application 94.

15 Equivalents

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The foregoing embodiments are therefore to be considered in all respects illustrative rather than limiting on the invention described herein. Scope of the invention is thus indicated by the appended claims rather than by the  
20 foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

CLAIMS

What is claimed is:

- 1 1. A method for managing network resources, the method comprising the steps of:
  - 2 a) allocating on a server at least one server resource to a client;
  - 3 b) monitoring activity of a user by said client to detect a change in the  
4 level of activity;
  - 5 c) transmitting to said server from said client a notification of change  
6 of activity; and
  - 7 d) managing at least one said allocated resource on said server in  
8 response to said notification.
- 1 2. The method of claim 1 wherein said notification of change of activity is in  
2 response to user inactivity.
- 1 3. The method of claim 2 further comprising the step of storing the state of the at  
2 least one allocated resource such that resumption occurs at substantially said same  
3 state in response to a subsequent notification of change of activity.

0099990-62282960

7 subsequent notification of change of activity.

2 server to said client said predefined display.

2 allocated resource on said server in response to said notification.

5 response to said second notification of change of activity.

1 9. The method of claim 7 further comprising the step of reducing at least one  
2 allocated resource in the network communication channel associated with  
3 maintaining communication between said server and said client.

1 10. The method of claim 2 wherein step (d) comprises reducing said at least one  
2 allocated resource to a predetermined level such that when the user resumes activity,  
3 resumption of said pre-reduced allocated resource is substantially transparent to said user.

1 11. The method of claim 2 wherein step (d) comprises the steps of:

2 (d-a) terminating communication with said client; and

3 (d-b) reducing said at least one allocated resource associated with  
4 maintaining communication with said client.

1 12. The method of claim 11 further comprising the steps of:

2 e) re-establishing said communication between said client and said  
3 server; and

4 f) transmitting to said server from said client a second notification of  
5 change of activity.

1 13. The method of claim 12 further comprising the step of initiating, by said client,  
2 the re-establishment of said communication between said client and said server.

009250:678560

- 1 14. A system for managing network resources, the system comprising:  
2 a server comprising:  
3 a resource manager; and  
4 a server communication link in communication with said resource  
5 manager; and  
6 a client in communication with said server, said client comprising:  
7 an activity monitor; and  
8 a client communication link in communication with said activity monitor,  
9 wherein said client activity monitor detects a level of activity of a user on  
10 said client and in response to a change in said level of activity transmits over said  
11 communication link to said server a notification of change of activity; and  
12 wherein said server resource manager, in response to said notification,  
13 manages said at least one server resource associated with said client.
- 1 15. The system of claim 14 wherein said notification of change of activity represents  
2 user inactivity.
- 1 16. The system of claim 14 wherein said server resource manager, in response to said  
2 notification, reduces at least one server resource associated with said client.

0093906228960

1 17. The system of claim 14 wherein said server further comprises a server first  
2 storage buffer in communication with said resource manager,  
3 wherein said server stores output data generated by an application in said  
4 first storage buffer in response to said notification.

1 18. The system of claim 17 wherein said server transmits said output data stored in  
2 said first storage buffer to said client in response to a subsequent notification of  
3 change of activity.

1 19. The system of claim 14 wherein said server further comprises:  
2 a server second storage buffer in communication with said resource  
3 manager,  
4 wherein said server stores the state of said at least one allocated resource  
5 when said notification is received, for resumption at substantially same said state  
6 in response to a subsequent notification of change of activity.

1 20. The system of claim 15 wherein said server further comprises:  
2 a server display generator in communication with said resource manager,  
3 wherein said display generator produces a display which said server  
4 transmits to said client and wherein said client displays said display following  
5 detection of a change in the level of activity.

1 21. The system of claim 15 wherein said client communication link initiates re-  
2 establishing communication with said server in response to said notification.

005679:06500

1     22.     A client for monitoring user activity, the client comprising:  
2                     an activity monitor; and  
3                     a communication link in communication with said activity monitor,  
4                     wherein said client activity monitor detects a level of activity of a user on  
5     said client and in response to a change in said detection transmits over said  
6     communication link to an external server a notification of change of activity.

1     23.     The client of claim 22 wherein said notification of change of activity represents  
2     user inactivity.

1     24.     The client of claim 22 wherein said client communication link initiates re-  
2     establishing communication with said server in response to said notification.

1     25.     The client of claim 22 wherein said activity monitor further comprises:  
2                     a notification generator;  
3                     an inactivity timer in communication with said notification generator; and  
4                     a user detection I/O in communication with said inactivity timer and said  
5     notification generator,  
6                     wherein said user detection I/O detects lack of activity of a user on said  
7     client and transmits detection to said inactivity timer and in response to this  
8     detection said inactivity timer starts counting until it is either reset by detection of  
9     activity by said user I/O or counts to a predetermined value; and wherein said  
10    notification generator, in response to said inactivity timer reaching said

005950:0626500

11 predetermined value transmits over the communication link to an external server a  
12 notification of change of activity.

1 26. The client of claim 25 wherein subsequent to said inactivity timer reaching said  
2 predetermined value, said user detection I/O detects resumption of activity of a  
3 user and in response to this detection, said notification generator transmits over  
4 the communication link to an external server a notification of change of activity.

1 27. A server for managing resources allocated to an external client, the server  
2 comprising:

3 a resource manager; and

4 a communication link in communication with said resource  
5 manager,

6 wherein said server resource manager, in response to a notification of  
7 change of activity from an external client received over the communication link,  
8 manages said at least one server resource associated with said external client.

1 28. The server of claim 27 wherein said notification of change of activity represents  
2 user inactivity.

1 29. The server of claim 27 wherein said server resource manager, in response to said  
2 notification received over the communication link, reduces at least one server  
3 resource associated with said external client.

0957879-053600

- 1     30.     The server of claim 27 wherein said server further comprises:  
2                             a first storage buffer in communication with said resource  
3     manager,  
4                             wherein said server stores output data generated by an application in said  
5     first storage buffer in response to said notification.
- 1     31.     The server of claim 30 wherein said server transmits said output data stored in  
2     said storage buffer to said external client in response to a subsequent notification  
3     of change of activity.
- 1     32.     The server of claim 27 wherein said server further comprises:  
2                             a storage buffer in communication with said resource manager,  
3                             wherein said server stores the state of said at least one allocated resource  
4     in said storage buffer , such that when subsequent notification is received in  
5     response to a change of activity, resumption occurs at substantially said same  
6     state.
- 1     33.     The server of claim 27 wherein said server further comprises:  
2                             a server display generator in communication with said resource  
3     manager,  
4                             wherein said display generator produces a display which said server  
5     transmits to an external client for displaying following detection of a change in  
6     the level of activity.

0057879-059900

Abstract

An apparatus and method for monitoring the activity level of a user by the client and managing the network resources, including server resources, in response to the level of activity identified by the client. In one embodiment the invention relates to a method for managing network resources, in response to the level of activity identified by the client. In another embodiment the invention relates to a system for managing network resources, in response to the level of activity identified by the client. In still yet another embodiment the invention related to a server for managing resources allocated to an external client, in response to the level of activity identified by the client.

0092906782500

FIG. 1

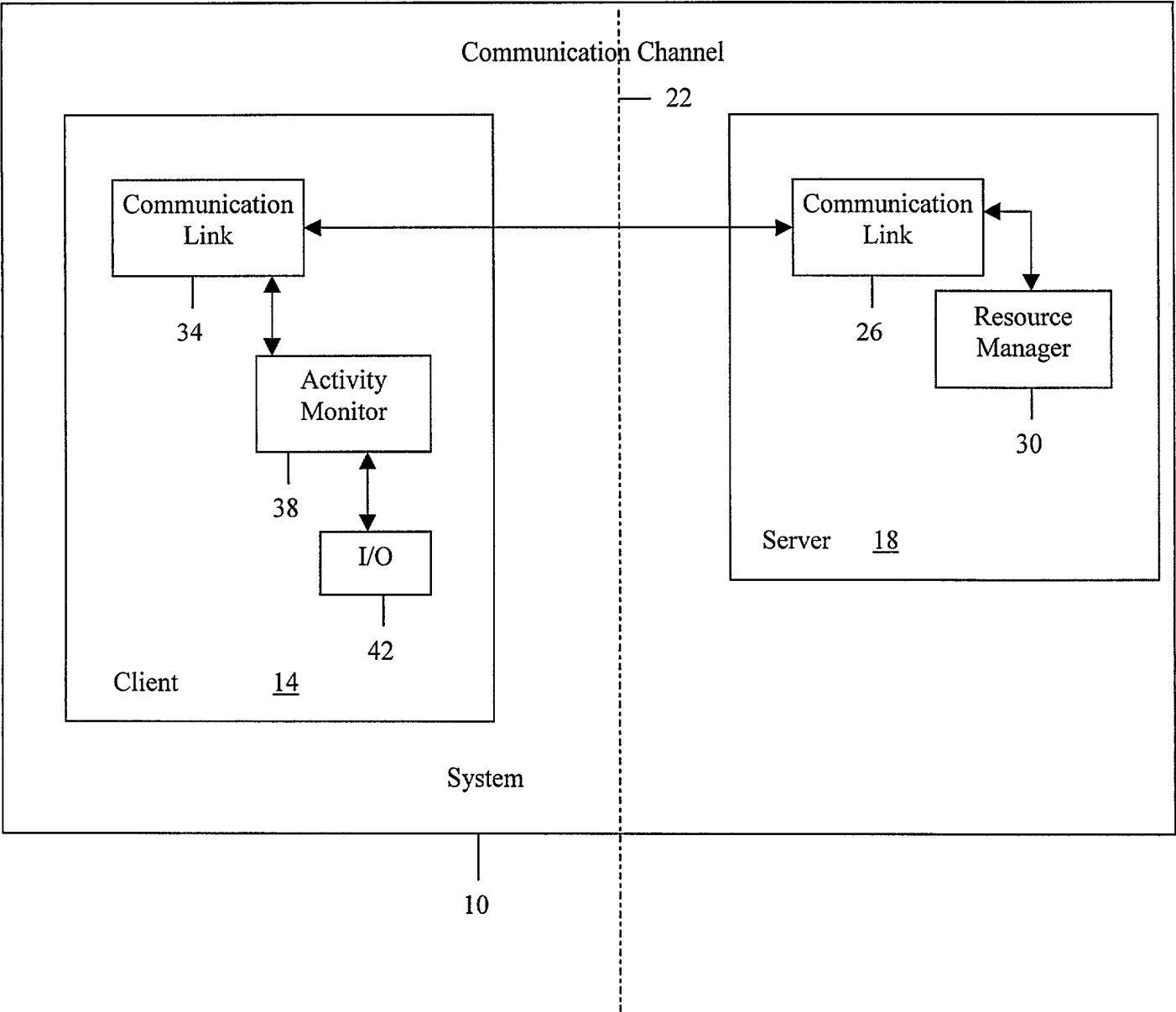


FIG. 2

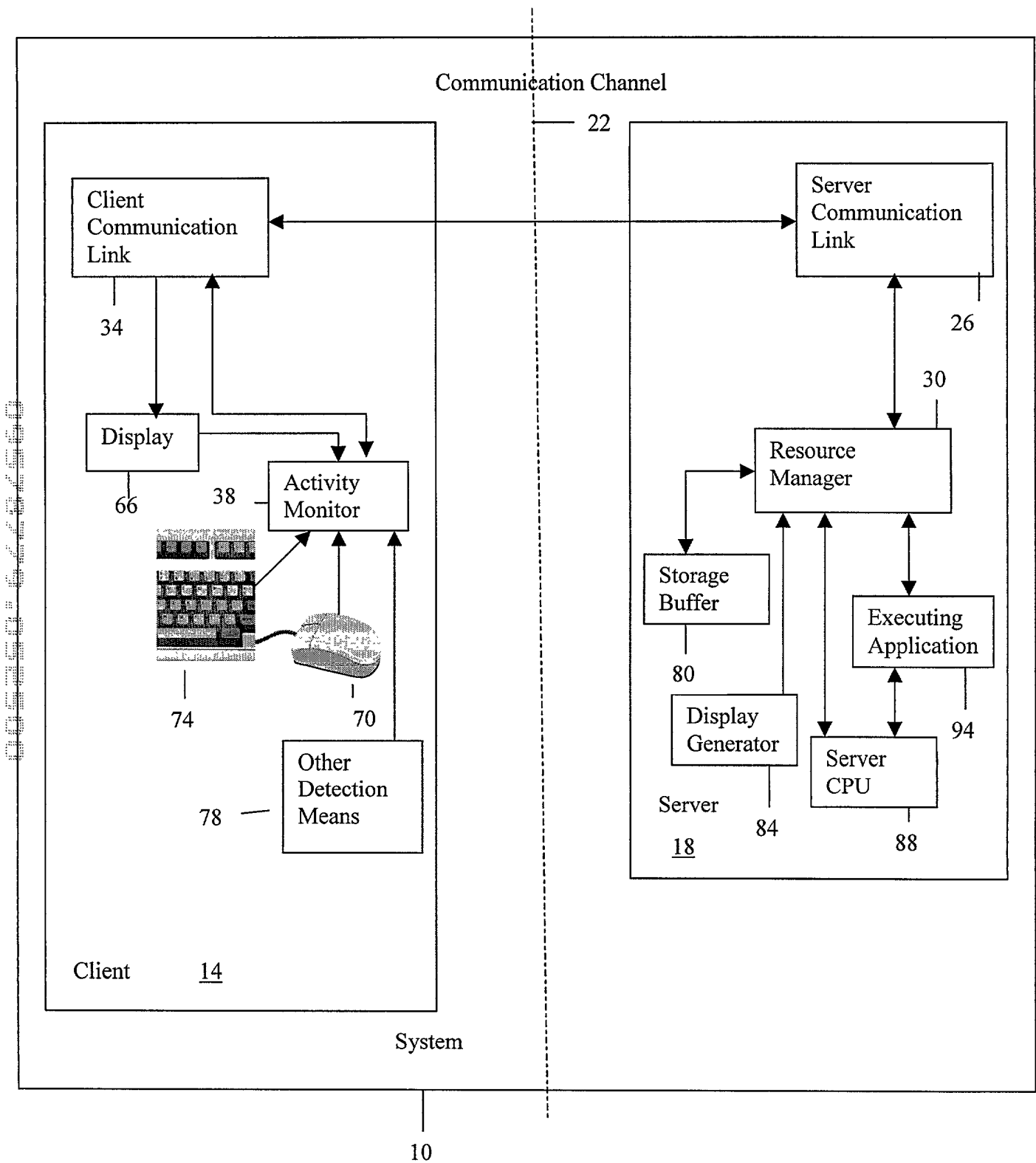


FIG. 3

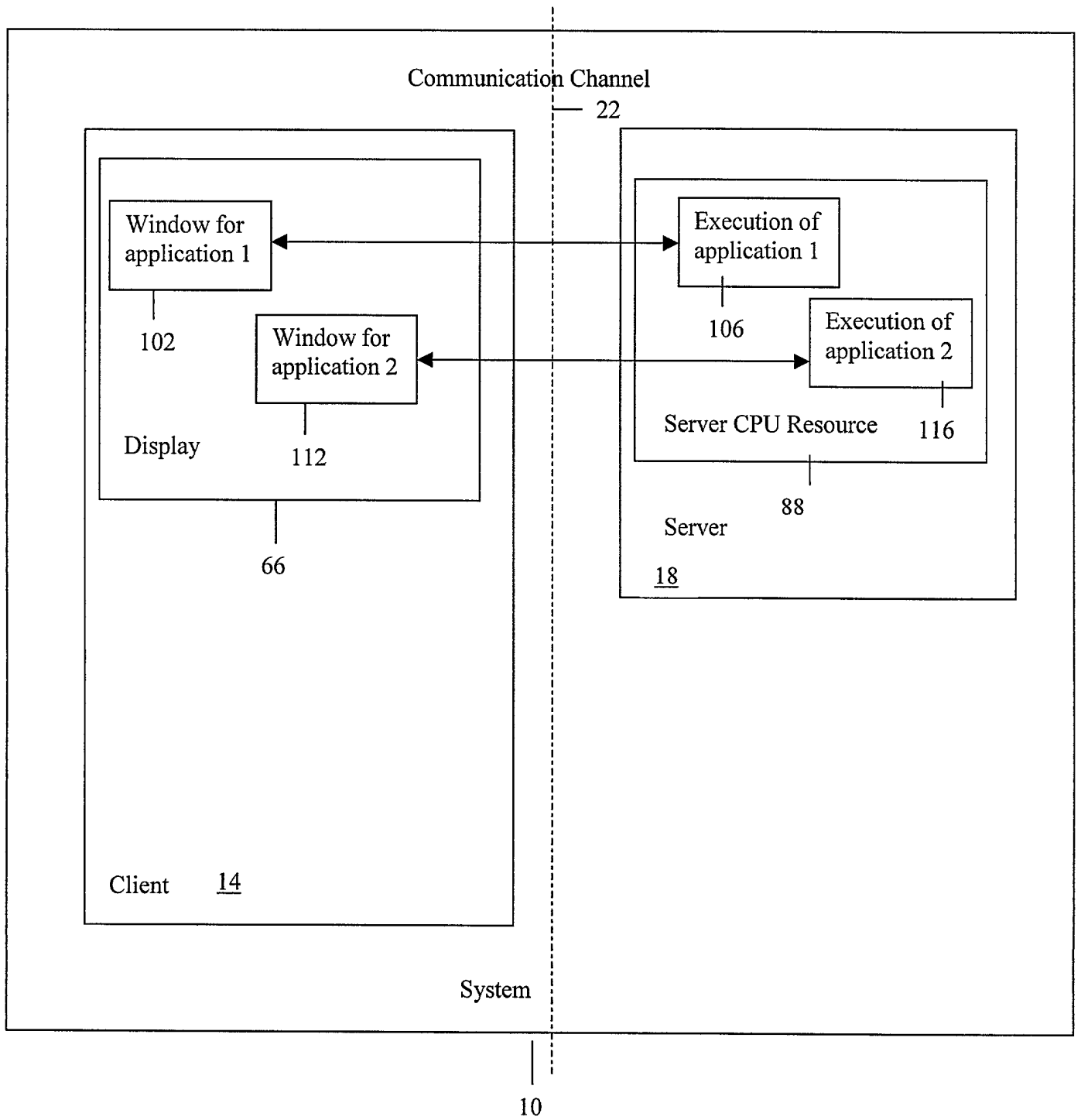
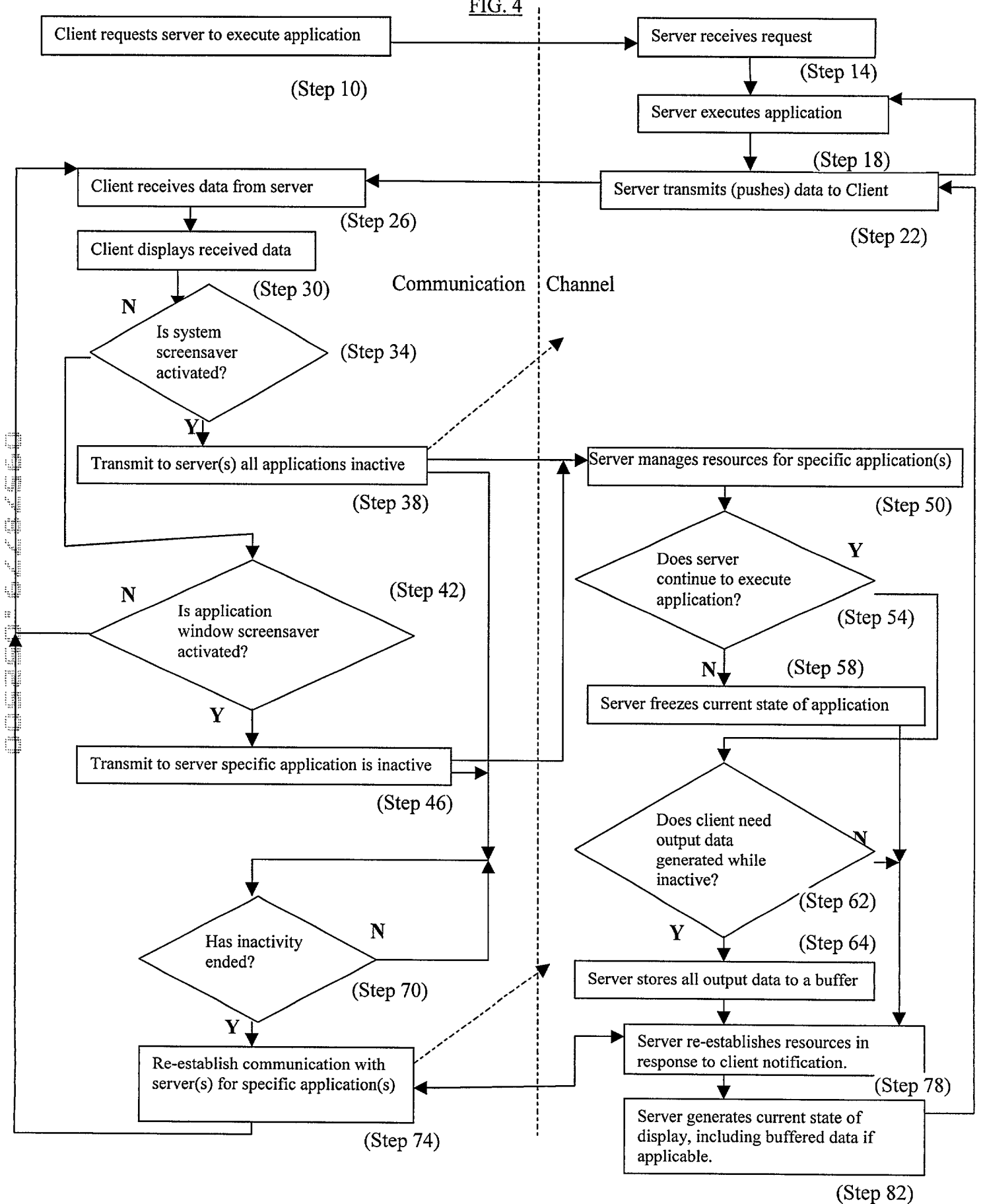


FIG. 4



|  |                           |                   |
|--|---------------------------|-------------------|
| <b>DECLARATION AND POWER<br/>OF ATTORNEY FOR UTILITY<br/>OR DESIGN<br/><br/>PATENT APPLICATION</b><br><br><input checked="" type="checkbox"/> Declaration <input type="checkbox"/> Declaration<br>Submitted with      Submitted after Initial<br>Initial Filing      Filing (surcharge<br>37 CFR 1.16(e) required) | Attorney Docket No.       | CTX-049 (1545/83) |
|  | First Named Inventor      | Richard Hayton    |
|  | <b>COMPLETE IF KNOWN</b>  |                   |
|  | Application Serial Number | Not Yet Assigned  |
|  | Filing Date               | Herewith          |
|  | Group Art Unit            | Not Yet Assigned  |
|  | Examiner Name             | Not Yet Assigned  |

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

ACTIVITY MONITOR AND RESOURCE MANAGER IN A NETWORK ENVIRONMENT

(Title of the Invention)

the specification of which

☒ is attached hereto  
OR

☐ was filed on \_\_\_\_\_ as United States Application Serial Number or PCT International (MM/DD/YYYY)

Application Number \_\_\_\_\_ and was amended on (MM/DD/YYYY) \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose to the Patent Office all information known by me to be material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

| Prior Foreign Application Number(s) | Country | Foreign Filing Date (MM/DD/YYYY) | Priority Not Claimed     | Certified Copy Attached? |                          |
|-------------------------------------|---------|----------------------------------|--------------------------|--------------------------|--------------------------|
|                                     |         |                                  | <input type="checkbox"/> | YES                      | NO                       |
|                                     |         |                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|                                     |         |                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|                                     |         |                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

☐ Additional foreign application numbers are listed on a supplemental priority data sheet attached hereto.

I hereby claim the benefit under 35 U.S.C. 119(c) of any United States provisional application(s) listed below.

| Application Serial Number(s) | Filing Date (MM/DD/YYYY) |  |
|------------------------------|--------------------------|--|
|                              |                          | <input type="checkbox"/> Additional provisional application serial numbers are listed on a supplemental priority data sheet attached hereto. |

005290 672560

## DECLARATION – Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c), of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

| U.S. Parent Application or PCT Parent<br>Serial Number | Parent Filing Date<br>(MM/DD/YYYY) | Parent Patent Number<br>(if applicable) |
|--|------------------------------------|---|
|  |                                    |   |

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet attached hereto.

As a named inventor, I hereby appoint the following registered practitioners to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: ☐ Customer Number

OR

☒ Registered practitioner(s) name/registration number listed below

Place Customer  
Number Bar Code  
Label Here

| Name                   | Registration<br>Number | Name                  | Registration<br>Number |
|------------------------|------------------------|-----------------------|------------------------|
| Steven M. Bauer        | 31,481                 | Thomas C. Meyers      | 36,989                 |
| John V. Bianco         | 36,748                 | Joseph B. Milstein    | 42,897                 |
| Isabelle A.S. Blundell | 43,321                 | David G. Miranda      | 42,898                 |
| Maurcen A. Bresnahan   | 44,559                 | Ronda P. Moore        | 44,244                 |
| Michael H. Brodowski   | 41,640                 | Edmund R. Pitcher     | 27,829                 |
| Jennifer A. Camacho    | 43,526                 | Dianne M. Rees        | 45,281                 |
| Joseph A. Capraro, Jr. | 36,471                 | Michael A. Rodriguez  | 41,274                 |
| John J. Cotter         | 38,116                 | Jamie H. Rose         | 45,054                 |
| John V. Forcier        | 42,545                 | R. Stephen Rosenholm  | 45,283                 |
| Michael J. Giannetta   | 42,574                 | Christopher W. Stamos | 35,370                 |
| Duncan A. Greenhalgh   | 38,678                 | Joseph P. Sullivan    | 45,349                 |
| William G. Guerin      | 41,047                 | Robert J. Tosti       | 35,393                 |
| Jonathan A. Harris     | 44,744                 | Thomas A. Turano      | 35,722                 |
| Ira V. Heffan          | 41,059                 | Michael J. Twomey     | 38,349                 |
| Danielle L. Herritt    | 43,670                 | Christine C. Vito     | 39,061                 |
| Mi Kim                 | 44,830                 | Patrick R.H. Waller   | 41,418                 |
| Douglas J. Kline       | 35,574                 | Daniel A. Wilson      | 45,508                 |
| John D. Lanza          | 40,060                 | Yin P. Zhang          | 44,372                 |
| Timothy P. Linkkila    | 40,702                 |                       |                        |
| Kurt W. Lockwood       | 40,704                 |                       |                        |

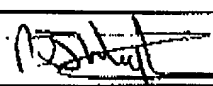
☐ Additional registered practitioners named on supplemental Registered Practitioner Information sheet attached hereto.

Direct all correspondence to:

Patent Administrator  
 Testa, Hurwitz & Thibault, LLP  
 High Street Tower  
 125 High Street  
 Boston, MA 02110  
 Tel. No.: (617) 248-7000  
 Fax No.: (617) 248-7100

005250-6262560

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

|  |   |   |       |                        |         |                |             |                          |
|--|---|---|-------|------------------------|---------|----------------|-------------|--------------------------|
| Name of Sole or First Inventor:  |   | <input type="checkbox"/> A petition has been filed for this unsigned inventor |       |                        |         |                |             |                          |
| Given Name (first and middle [if any])   |   |   |       | Family Name or Surname |         |                |             |                          |
| Richard  |   |   |       | Hayton                 |         |                |             |                          |
| Inventor's Signature   |  |   |       |                        |         | Date           | 24/5/00     |                          |
| Residence  | City  | Cambridge   | State |                        | Country | United Kingdom | Citizenship | British                  |
| Post Office Address  |   |   |       |                        |         |                |             | 2a Newnham Lane, Burwell |
| P.O. Address (line 2)  | City  | Cambridge   | State |                        | ZIP     | CB3 0EA        | Country     | United Kingdom           |
| <input type="checkbox"/> Additional inventors are being named on the supplemental Additional Inventor(s) sheet(s) attached hereto. |   |   |       |                        |         |                |             |                          |
| Name of Additional Joint Inventor, if any:   |   | <input type="checkbox"/> A petition has been filed for this unsigned inventor |       |                        |         |                |             |                          |
| Given Name (first and middle [if any])   |   |   |       | Family Name or Surname |         |                |             |                          |
|  |   |   |       |                        |         |                |             |                          |
| Inventor's Signature   |   |   |       |                        |         | Date           |             |                          |
| Residence  | City  |   | State |                        | Country |                | Citizenship |                          |
| Post Office Address  |   |   |       |                        |         |                |             |                          |
| P.O. Address (line 2)  | City  |   | State |                        | ZIP     |                | Country     |                          |
| Name of Additional Joint Inventor, if any:   |   | <input type="checkbox"/> A petition has been filed for this unsigned inventor |       |                        |         |                |             |                          |
| Given Name (first and middle [if any])   |   |   |       | Family Name or Surname |         |                |             |                          |
|  |   |   |       |                        |         |                |             |                          |
| Inventor's Signature   |   |   |       |                        |         | Date           |             |                          |
| Residence  | City  |   | State |                        | Country |                | Citizenship |                          |
| Post Office Address  |   |   |       |                        |         |                |             |                          |
| P.O. Address (line 2)  | City  |   | State |                        | ZIP     |                | Country     |                          |